

PATENT SPECIFICATION

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DRAWINGS ATTACHED.

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COMPLETE SPECIFICATION.

Electromagnetically Actuated Friction Clutch or Brake.

We, ALFRED BELLING and ELISABETH BELLING, both of 20, Im Kreuzfeld, Hameln, Germany, and both German citizens, trading as Maschinenfabrik Hans Lenze, of Mösingfeld/Lippe, Germany, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed to be particularly described in and by the following statement:—

This invention relates to an electromagnetically actuated clutch or brake of the kind in which an axially displaceable armature disc is arranged between a magnetic member which forms one of the clutch parts and which is axially non-displaceable, and the other clutch part, which is likewise axially non-displaceable, said armature disc, when the magnetic member is energised, being attracted by said member to engage the clutch or operate the brake. If, in the case of a clutch, the magnetic member participates in the rotation, the iron ring or disc carrying the magnetic coil serves as the magnetic member, while with a non-rotating magnetic member without a slip-ring, a separate pole ring or rotor which is mounted for rotation but not for axial displacement serves as the magnetic member.

In some electromagnetic clutches or brakes of this kind, no return spring is provided to pull the armature away from the magnetic poles after the magnet has been de-energized, with the result that a creeping separation of the armature disc from the magnetic poles takes place which may lead to a partial residual coupling moment and, particularly if the clutch or brake axis is not horizontal, to inadmissible heating of the clutch as a result of friction. In general, therefore, axially resilient members are provided for

withdrawing the armature from the magnetic poles by a short but definite distance after the de-energizing of the magnet. Leaf springs, steel or plastics diaphragms or helical springs have been used for this purpose.

Leaf springs require expensive securing means and lead to a design of unsatisfactory configuration. Diaphragms have the disadvantage that the two clamping points are unequally loaded and with plastics diaphragms in particular the operating temperature has to be kept low to avoid deformation which could result in variations in dimensions. When helical springs are used, driving members in the form of teeth, keys, cams or pins are necessary, which lead to disturbing play. In addition, such driving members tend to be deflected and in the majority of cases the cooperating surfaces require lubrication service.

It is an object of the invention to overcome the disadvantages of these known constructions.

According to the invention there is provided an electromagnetically actuable friction clutch or brake, in which the two clutch or brake parts, one of which is constructed as a magnetic member, are non-displaceable in the direction of their common axis, the other clutch or brake part having an armature disc connected thereto by a sinusoidally curved spring ring under initial tension, the apices of alternate sine curve portions of said spring ring being secured to said clutch or brake part and the apices of the other sine curve portions being secured to said armature disc.

An embodiment of the invention is illustrated by way of example in the accompanying drawing as applied to an electromagnetically actuated friction clutch without slip rings. In said drawing:

Figure 1 shows the main components of the clutch in cross-section, with the magnet de-energized in the upper half and energized in the lower half, the armature disc, spring ring and the associated clutch part being shown in full lines and the other clutch part and components in chain lines;

Figure 2 is a perspective view of the spring ring in the relaxed condition; and

Figures 3 and 4 are fragmentary sectional views of the armature disc and the spring ring.

A stationary annular magnetic member M has a pole ring or rotor R which constitutes one of the clutch parts and is mounted for rotation but not for axial displacement, said part being provided with a let-in friction lining B. The part R may, for example, be rigidly mounted on a driving shaft.

The other clutch part is formed by a ring 3 which is likewise mounted for rotation but not for axial displacement and is secured to a hub connected to the shaft to be driven or is mounted to be freely rotatable on the shaft carrying the rotor R and bolted directly to a machine part to be driven.

An armature disc 2 is provided between the clutch ring 3 and the clutch part R, and a spring ring 1 is secured by means of rivets to said disc and ring. As shown in Figure 2, the ring 1 is curved sinusoidally in the relaxed condition and is provided with connecting holes at the apices of the sine curve portions for the connecting rivets. Figure 3 illustrates the spring ring and the armature disc before being riveted together, while Figure 4 shows the spring ring riveted in tensioned condition to the armature disc. The spring ring is secured by alternate rivets to the armature disc and by the other rivets to clutch ring 3. The spring ring 1 is so dimensioned that the armature disc is displaceable axially under the influence of the force of the energized magnet and the spring transmits the torque from the armature disc to the clutch ring.

In comparison with a spring ring which is completely flat in the relaxed condition and which is only tensioned when the armature disc is attracted by the magnet and which, after being relaxed on the withdrawal of the armature disc from the magnet or from the pole surfaces of the rotor, does not exert any restoring force on the armature disc bearing against the clutch ring, the sinusoidally curved spring ring, as a result of the initial tension imparted thereto when it is

secured to the clutch ring exerts a restoring force on the armature disc, even when the latter is completely withdrawn from the clutch lining B as shown at the upper part of Figure 1, so that the armature disc is resiliently held in the retracted position and no relative movement or chattering of the disc 2 and clutch ring 3 can occur. In addition, as illustrated somewhat exaggerated in Figure 4, for the sake of clarity, minor deformations of the annular spring remain to both sides of the connecting rivets and these serve as a cushion when the armature jumps back and have a sound-damping effect.

With large clutch units and correspondingly large transmitting torques, a plurality of annular springs may be stacked and secured against one another, or individual ring segments may be combined to form a ring if the width of the spring steel available commercially is not large enough for a complete ring to be stamped out of it.

Where the invention is used in an electromagnetically actuated brake the flange 3 will be stationary.

WHAT WE CLAIM IS:—

1. An electromagnetically actuatable friction clutch or brake, in which the two clutch or brake parts, one of which is constructed as a magnetic member, are non-displaceable in the direction of their common axis, the other clutch or brake part having an armature disc connected thereto by a sinusoidally curved spring ring under initial tension, the apices of alternate sine curve portions of said spring ring being secured to said clutch or brake part and the apices of the other sine curve portions being secured to said armature disc.

2. A friction clutch or brake as claimed in Claim 1, wherein the spring ring comprises a plurality of combined ring segments.

3. A friction clutch or brake as claimed in Claim 1, wherein a plurality of spring rings are stacked and secured against one another.

4. A friction clutch or brake substantially as described with reference to and as illustrated in the accompanying drawing.

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